ZOELLER ENGINEERED PRODUCTS

Nameplate Voltage vs Supply Voltage

In many cases, the voltage listed in a set of plans or specifications does not match the voltage listed for a pump or vice versa. To understand why the voltages may differ we must first differentiate between nameplate voltage and supply voltage.

Nameplate Voltage- The voltage that a motor is rated for. Typically, available in multiples of 115 volts (115, 230, 460, and 575 volts) except for 200V.

Supply Voltage- Also known as service voltage, is the voltage supplied by the utility to the house, building, site, etc. Typically, available in multiples of 120 volts (120, 240, 480, and 600 volts) except for 208V.

Why do these voltages differ?

One reason these voltages differ is for allowable variances. Utility companies are required to provide supply voltages within a range of plus or minus 5% from the nominal supply voltage. Therefore, a typical 120V service can be as high as 126V (+5%) or as low as 114V (-5%). NEMA thus recommends that all motors should be operable within a range of plus or minus 10% of the motor's nameplate voltage. Therefore, a 115V motor is rated to operate between 126.5V (+10%) to 103.5V (-10%). The larger variance in the motor (+/-10%) allows for safe operation for the full acceptable range of the supply voltage (+/-5%).

Why is the minimum allowable voltage for the motor significantly lower than the minimum supply voltage?

The lower nameplate voltage of the motor is to allow for voltage drop and loss that is inherent to all electrical systems. All electrical wire has some resistance to current flow based on the length and diameter of the wire. This resistance, known as impedance, causes voltage drop. As wire diameter is decreased, or the length of the wire from the power source to the motor is increased, the voltage drop increases. Additionally, simultaneous operation of electrical components can cause a voltage drop by increasing the amp-draw through a circuit: increased amp draw, increases impedance, which increases voltage drop. This is why lights may flicker or dim when a large piece of equipment starts up. It is recommended for pumps to be installed on their own dedicated circuit and with a properly sized power cord to minimize the effects of nuisance tripping of breakers and voltage drop due to electrical impedance.

Although a pump can operate +/- 10% of the of the nameplate voltage, it is not recommended. Periodic instances of high or low voltage will not be detrimental to the equipment, but continued operation at the +/- 10% extremes can severely shorten the life of the pump and decrease the efficiency. Low voltage will increase the amp draw, which will thus increase the heat of the motor; this increased heat will shorten the motor's life. Low voltage also reduces the starting torque, a key component to sewage pumps and grinder pumps. All pumps have a minimum starting torque to get the impeller up to speed and to cut through material that may be caught around the cutting blade of a grinder. If the torque is too low the impeller or cutting assembly may lock up. On the other side, higher voltage will reduce the power factor which will reduce the efficiency of the pump. Reduced efficiency then increases the electrical costs to operate the pump. With all of this taken into consideration it is recommended to operate pumps within +/- 5% of the nameplate voltage. Operating the pump at or near the

pump's nameplate voltage will ensure the longest life and best efficiency.
The chart below gives a quick reference for matching the supply voltage (utility) to the accepted nameplate voltage (motor rating).

Supply Voltage (Voltage from Utility)	Nameplate Voltage (Motor Rating)
120 V	115 V
208 V	200 V
240 V	230 V
480 V	460 V
600 V	575 V